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MARKETING OF GYPSUM PRODUCTS

BY

R. M. SANTMYERS

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Circular No. 6157,

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DEPARTMENT OF COMMERCE - BUREAU OF MINES

MARKETING OF GYPSUM PRODUCTS [1]

By R. M. Santmyers[2]

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INTRODUCTION

The increasing use of gypsum, especially in building construction, emphasizes the need for careful analysis of the basic factors of marketing gypsum products. In the past, plants were erected where likely deposits were present and little thought was given to the real potentialities of a market, beyond a simple faith in the growing demand in nearby territory. As a result there are plants in several States to-day that are an economic detriment to the industry, for they must seek markets far from the source of production or attempt to enter the logical markets of other plants through the profitless gateway of price cutting.

Within the past decade, and more especially within the last two years, there has been a growing tendency among operators to study markets and to analyze labor conditions before building a plant. Certain of the larger companies, though still having regard to sources of raw materials, are to-day erecting plants at strategic centers of consumption. In some cases - for example, where cheap water transportation is available - the raw materials may be brought to the plant over fairly long distances. For most gypsum products the manufacturing process adds very little to the ultimate weight of the finished goods, and the rates on crude gypsum are, of course, substantially less than upon finished products made therefrom. The conditions of transportation, however, should be known beforehand; otherwise the odds are against marketing the product at prices that will assure the return of the capital invested.

Gypsum is marketed in three distinct forms: (1) As crude rock for use as a retarder in the Portland Cement industry; (2) as ground crude gypsum for fertilizer, and as a filler in paint, paper, cloth, etc.; and (3) as calcined gypsum which is used principally in building construction.

In the present report the marketing of each of these forms of gypsum will be discussed separately, and then the distribution of the gypsum mills will be considered with particular reference to the market areas which they serve. Finally an analysis will be made of some of the fundamental factors relative to plant location, sales territories, and distribution. Table 1 shows the production and sales of gypsum in the United States from 1890 to 1927, and Table 2 gives the production by States throughout the same period.

SALES OF CRUDE GYPSUM

Consumption by Cement Plants

During the past decade the sales of crude gypsum have increased 100 per cent, due largely to increased purchases by cement mills. In 1918 the total sales of crude gypsum amounted to 470,192 short tons, of which the Portland cement plants took 403,635 tons, or 86 per cent. For 1927 the total sales were 965,371 short tons, of which the cement mills took 928,307 tons, or 96 per cent. Considerable quantities of crude gypsum are imported from Canada, Mexico, and other foreign countries. Canada, however, furnishes the larger part of the foreign gypsum, most of which is consumed along the Atlantic seaboard at cement plants, as land plaster, and for the manufacture of gypsum building-construction materials.

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Table 1.- Production and sales of gypsum in the United States, 1890 - 1927

Year	Total quantity	Sold crude: Quantity, short tons	Sold crude: Value	Sold crude: Price per ton	Ground into land plaster: Quantity, short tons	Ground into land plaster: Value	Ground into land plaster: Price per ton	Calcined and plaster of Paris: Quantity, short tons	Calcined and plaster of Paris: Value	Calcined and plaster of Paris: Price per ton	Total value of sales	Percentage sold as crude
1890	182,995	18,742	$ 19,148	$1.02	56,525	$143,014	$2.53	79,257	$ 412,361	$5.20	$ 574,523	10
1891	208,126	18,574	28,690	1.54	51,700	117,356	2.27	110,006	482,005	4.38	628,051	9
1892	256,259	58,080	80,797	1.39	47,668	106,247	2.23	106,141	508,448	4.79	695,492	23
1893	253,615	42,808	71,860	1.68	50,408	106,365	2.11	122,937	518,390	4.22	696,615	17
1894	239,312	34,702	56,149	1.62	41,996	95,944	2.28	127,158	609,626	4.79	761,719	15
1895	265,503	26,624	37,837	1.42	35,079	85,355	2.43	150,801	674,255	4.47	797,447	10
1896	224,254	17,302	19,134	1.11	27,354	59,749	2.18	137,505	494,461	3.60	573,344	8
1897	288,982	23,164	27,020	1.17	31,562	67,083	2.13	180,935	661,761	3.66	755,864	8
1898	291,638	5,758	7,200	1.25	40,929	90,777	2.22	190,083	657,303	3.46	755,280	2
1899	486,235	58,352	66,762	1.14	50,033	100,797	2.01	286,227	1,119,521	3.91	1,287,080	12
1900	594,462	35,479	44,127	1.24	45,682	82,806	1.81	396,284	1,500,270	3.79	1,627,203	6
1901	633,791	68,669	71,773	1.05	59,058	109,551	1.85	399,686	1,325,317	3.31	1,506,641	11
1902	816,478	81,455	93,914	1.15	60,791	106,237	1.75	539,387	1,889,190	3.50	2,089,341	10
1903	1,041,704	73,912	87,608	1.19	74,601	154,945	2.08	742,543	3,550,390	4.78	3,792,943	7
1904	940,917	56,137	61,234	1.09	70,167	142,490	2.03	665,340	2,580,601	3.88	2,784,325	6
1905	1,043,202	67,105	106,041	1.58	40,196	74,280	1.85	736,708	2,848,906	3.87	3,029,227	6
1906	1,540,585	186,999	460,545	2.46	62,671	157,292	2.50	899,581	3,220,138	3.58	3,837,975	12
1907	1,751,748	232,546	424,227	1.82	46,851	115,841	2.47	1,125,301	4,402,196	3.91	4,942,264	13
1908	1,721,829	209,031	334,009	1.60	37,672	91,623	2.43	1,125,617	3,650,192	3.24	4,075,824	12
1909	2,252,785	292,274	448,814	1.54	49,581	103,695	2.09	1,514,037	5,354,229	3.54	5,906,738	13
1910	2,379,057	368,014	559,172	1.52	53,815	110,325	2.05	1,583,669	5,853,532	3.70	6,523,029	15
1911	2,323,970	334,600	491,906	1.47	52,880	97,573	1.85	1,598,418	5,872,556	3.67	6,462,035	14
1912	2,500,757	388,543	516,464	1.33	53,065	107,058	2.02	1,731,674	5,940,386	3.43	6,563,908	16
1913	2,599,508	408,321	601,113	1.47	54,815	95,953	1.75	1,773,849	6,077,756	3.43	6,774,822	16
1914	2,476,465	390,742	549,083	1.41	52,945	97,716	1.85	1,656,066	6,249,190	3.77	6,895,989	16
1915	2,447,611	406,393	528,161	1.30	69,256	122,714	1.77	1,613,720	5,946,018	3.68	6,596,893	17
1916	2,757,730	465,240	623,294	1.34	81,879	167,136	2.04	1,805,814	7,168,602	3.97	7,959,032	17
1917	2,696,226	539,627	893,562	1.66	84,366	230,808	2.74	1,677,390	9,992,082	5.96	11,116,452	20
1918	2,057,015	405,621	980,836	2.42	64,571	255,716	3.96	1,328,269	10,234,302	7.70	11,470,854	20
1919	2,420,163	470,267	1,332,637	2.83	39,978	185,566	4.64	1,596,020	14,209,704	8.90	15,727,907	19
1920	3,129,142	561,817	2,007,270	3.57	107,443	557,925	5.19	1,904,484	21,967,870	11.53	24,533,065	18
1921	2,890,784	537,978	1,775,109	3.30	104,966	490,902	4.68	1,796,851	21,434,279	11.93	23,700,290	19
1922	3,779,949	668,821	2,056,143	3.07	101,904	387,203	3.80	2,491,265	26,917,805	10.80	29,361,151	18
1923	4,753,448	821,816	2,427,410	2.95	25,426	150,026	5.90	3,101,378	32,310,719	10.42	34,888,155	17
1924	5,042,629	959,810	2,548,708	2.66	22,298	125,612	5.63	3,568,569	40,050,187	11.22	42,724,507	19
1925	5,678,302	988,134	2,669,327	2.70	26,001	153,902	5.92	4,096,357	44,754,011	10.93	47,577,240	17
1926	5,635,441	934,069	2,357,969	2.52	27,294	151,916	5.57	4,015,974	44,211,334	11.01	46,721,219	17
1927	5,346,888	935,919	2,258,838	2.41	29,452	129,825	4.41	3,912,211	39,785,791	10.17	42,174,454	18

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Table 2.- Gypsum production in the United States by States, 1890-1927 (Short tons)

Year	Iowa	Kansas	Michigan	Nevada	New York	Ohio	Okla.	Tex.	Utah	Va.	Other States	Total mined	Value of sales
1890	20,900	20,250	74,877		32,903	12,748				6,350	14,967	182,995	$ 574,523
1891	31,385	40,217	79,700		30,135	9,123			3,000	5,959	13,327	212,846	647,451
1892	12,000	46,016	139,557		32,394	13,275		1,926	2,600	6,991	1,500	256,259	695,492
1893	21,447	43,631	124,590		36,126	11,646		4,011		7,014	5,150	253,615	696,615
1894	17,906	64,889	79,958		31,798	20,827	1,300	6,925	1,920	8,106	5,683	239,312	761,719
1895	25,700	72,947	66,519		33,587	21,662	13,100	10,750	2,134	5,800	13,304	265,503	807,447
1896	18,631	49,435	67,634		23,325	22,634	8,000	16,022	2,866	5,955	9,752	224,254	573,344
1897	29,430	54,353	94,874		33,440	18,592	10,734	24,454	2,700	6,374	14,031	288,982	755,864
1898	24,733	59,180	93,181		31,655	21,303	3,150	34,215	2,610	8,378	13,233	291,638	755,280
1899	75,574	85,046	144,776		52,149	27,205	23,526	53,773	2,352	11,480	10,354	486,235	1,287,080
1900	184,600	48,636	129,654	1,000	58,690	39,034	24,937	80,622	2,397	11,940	12,752	594,462	1,627,203
1901	213,419	(1)	185,150		119,565		15,930	(1)		15,236	84,491	633,791	1,506,641
1902	295,769	(1)	240,227		110,364	101,545	34,156	(1)		(2)	34,417	816,478	2,089,341
1903	307,102	(1)	269,093		137,886	103,392	69,158	(1)		(2)	155,073	1,041,704	3,792,943
1904	145,359	173,721	238,385		158,892	101,809	53,523	(3)		(2)	69,228	940,917	2,784,325
1905	179,016	47,276	299,585		153,367	134,276	148,947	(4)		(2)	80,735	1,043,202	3,029,227
1906	286,857	105,091	341,716		238,631	132,805	247,937	(4)		(2)	137,548	1,540,585	3,837,975
1907	251,874	155,980	317,261		324,507	202,253	282,461	(4)		(2)	217,412	1,751,748	4,942,264
1908	240,270	130,184	327,810		318,045	178,904	272,193	(4)		(2)	254,422	1,721,829	4,075,824
1909	319,577	137,697	394,907		403,929	239,517	338,526	(4)		(2)	368,632	2,252,785	5,906,738
1910	322,713	135,088	357,174	103,329	467,339	292,987	162,788	188,559	46,279	(2)	302,801	2,379,057	6,523,029
1911	354,204	122,579	347,296	133,960	472,834	360,858	108,653	179,625	(5)	(2)	243,961	2,323,970	6,462,035
1912	411,186	131,031	384,297	122,408	506,996	262,551	135,074	160,863		(2)	386,351	2,500,757	6,563,908
1913	456,031	110,510	423,896		529,627	254,863	147,876	161,090			515,615	2,599,508	6,774,822
1914	480,404	80,774	393,006		523,368	265,091	113,103	158,814	44,950		416,955	2,476,465	6,395,989
1915	495,860	60,919	389,791		540,914	259,036	110,790	176,306	23,445		390,550	2,447,611	6,596,893
1916	522,293	78,257	457,375		579,827	286,678	161,661	197,785			473,854	2,757,730	7,959,032
1917	461,864	79,331	375,803		606,268	270,538	158,017	257,328			487,077	2,696,226	11,116,452
1918	327,927	54,958	286,768		531,038	199,456	126,208	157,388			373,272	2,057,015	11,470,854
1919	421,279	78,479	339,125	91,756	591,153	251,259	114,313	176,607			356,192	2,420,163	15,727,907
1920	571,895	130,044	382,212	143,929	780,295	277,899	135,279	220,157			487,432	3,129,142	24,533,065
1921	350,247	92,526	408,224	178,275	712,665	363,905	209,201	232,806			342,935	2,890,784	23,700,290
1922	536,905	105,481	471,355	276,859	1,055,302	435,485	242,932	221,914	48,338		385,378	3,779,949	29,361,151
1923	685,041	135,019	586,987	298,390	1,361,116	526,861	290,121	344,104	44,531		481,278	4,753,448	34,888,155
1924	727,385	141,908	577,526	365,714	1,474,491	525,485	316,134	402,245	90,221		421,520	5,042,629	42,724,507
1925	800,167	166,952	649,053	350,130	1,730,254	551,479	320,931	558,132			551,204	5,678,302	47,577,240
1926	802,910	195,440	659,685	350,972	1,723,460	521,205	324,021	533,156	36,333		488,259	5,635,441	46,721,219
1927	792,159	175,351	668,617	327,365	1,675,501	474,320	271,484	508,382			453,709	5,346,888	42,174,454

Notes:- 1/Included in Iowa figures (both Kansas and Texas). 2/Included in Ohio figures (Virginia); Ohio, 1902, figure also included California. 3/Included in Kansas figures (Texas). 4/Included in Oklahoma figures (Texas). 5/Included in Nevada figures (Utah); Nevada 1910, figure included Oregon.

In recent years there has been a considerable increase in the tonnage of imported gypsum that is sold in the crude state. During 1927 eight companies reported imports amounting to 785,476 short tons of crude gypsum, of which 107,307 tons was sold crude, all to cement plants except about 12,000 to 15,000 tons which was used as a fertilizer in Virginia and North Carolina. This is a decided increase over previous years and will no doubt show additional increases in the future as the requirements for cement grow.

A considerable amount of crude domestic gypsum will be shipped by water from Alabaster, Mich., on Lake Huron, to Detroit and Chicago upon completion of plants at these two points. This will be the first time in recent years that domestic crude gypsum will be shipped inland for fabrication at places other than at point of production, and no doubt will create a saving in the cost of handling the finished products, as the potential markets at these localities are sufficiently large to absorb the entire output of the fabricating plants.

In the West some crude gypsum from Mexico is shipped direct to cement plants both before and after crushing to size. Although the figures are not as large as those in the eastern States, they compare favorably with total imports of the crude rock. According to figures published by the Bureau of Foreign and Domestic Commerce, the imports of crude gypsum rock from Mexico in 1927 amounted to 68,387 short tons, valued at $62,035. The importers, however, state that during that year some 51,000 tons was brought in, of which about 2,100 tons was sold crude.

The use of gypsum in the Portland cement industry is steadily increasing, and when the results of using anhydrite (which is often associated with gypsum) become better known, it will likewise be used for the same purpose as gypsum. According to Table 1, the sales of crude gypsum to cement plants for the years 1920 to 1927, have averaged 799,446 short tons annually - the high year was 1925, when 988,134 tons was sold, as compared with 537,978 tons in 1921, the low year.

At several plants the crude gypsum is passed through screens. Many cement mills accept readily everything that passes a 3-inch ring. Other mills, on account of the nature of the feeding devices used, require smaller sizes and a few mills insist that the fines be taken out. In order to compete successfully for cement mill business, gypsum plants must be near the cement mills. Due to its relatively low value per ton, crude gypsum is unable to stand a long freight haul. Some cement companies mine and crush their own gypsum, but this is far from being the common practice.

Crude gypsum is usually shipped to cement mills in bulk. The mills ordinarily keep a stock of two or three weeks' supply on hand and try to time shipments of gypsum into the mills with those of cement going out. For this reason they may require the gypsum to be loaded into box cars; otherwise either box cars or drop-bottom hopper cars are used.

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The trend in the sales of crude gypsum to the cement industry for use as a retarder follows fairly closely the industry's production (fig. 1), which in turn is affected by the amount of building construction and highway programs in progress in the United States. The peak year in the building construction industry in the United States coincided with that of the sales of crude gypsum to the cement industry.

In 1925 the value of buildings as shown by permits issued in 210 cities in the United States amounted to $3,987,475,000, while the sales of crude gypsum amounted to 988,134 tons valued at $2,669,327; these figures are the highest yet attained in either industry. (See fig. 3.)

Table 3.- Sales of Crude Gypsum to Cement Plants and Total Sales of Portland Cement

Year	Crude gypsum sold		Portland cement sold	
	Quantity, short tons	Value	Quantity, short tons	Value
1920	561,817	$2,007,270	18,106,603	$194,439,025
1921	537,978	1,775,109	17,955,344	180,778,415
1922	668,821	2,056,143	22,127,829	207,170,430
1923	821,816	2,427,410	25,551,478	257,684,424
1924	959,810	2,548,708	27,456,939	264,046,708
1925	988,134	2,669,327	29,571,499	278,524,108
1926	928,885	2,326,635	30,491,173	277,965,475
1927	928,307	2,237,548	32,310,569	278,854,647

Agricultural Uses

Practically the first use for gypsum in the United States was for land plaster, and down to the year 1889 nearly two-thirds of the quarried gypsum was used for this purpose. In the early 70's the mills in Michigan could not supply the demand, though they were run day and night, and the material sold at a high price of $4.50 per ton. In 1890 the uses of gypsum in this country were reversed in ratio, and nearly twice as much rock was calcined as was used for fertilizer. By 1893 the proportion was three to one, and in 1898 the amount of gypsum calcined was six times that ground into land plaster. To-day it is about 14 times as great.

One cause for this change was a growing doubt as to whether land plaster actually produced the wonderful results that had been claimed for it; certain writers tried to show that the benefits derived were not permanent. Another factor was the increasing popularity of commercial fertilizers composed of various ingredients. Big companies were organized over the country, who, aided by large capital, careful preparation of materials, and judicious advertising, were able to sell at a reasonable price patent phosphate fertilizers embodying the good points of gypsum and having other valuable qualities in addition.

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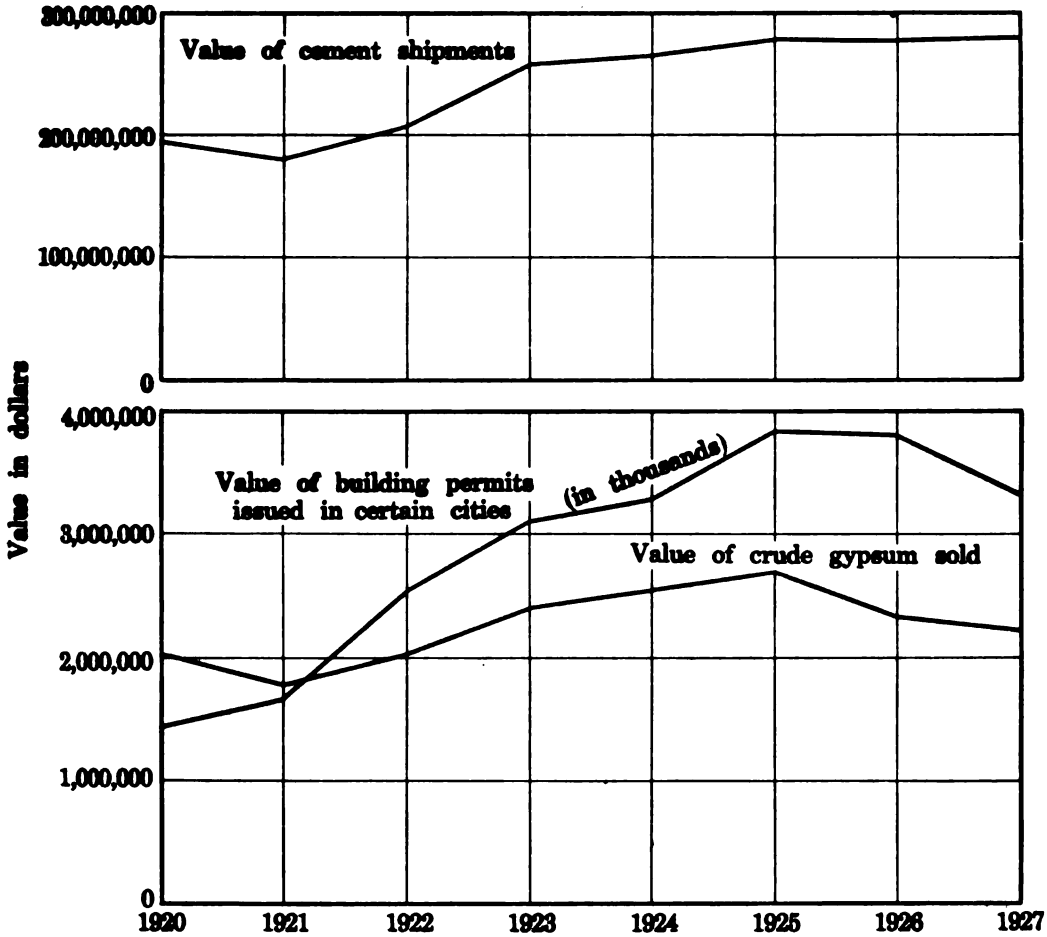

Figure 1.– Comparison of value of sales of crude gypsum to cement plants with value of cement shipments and of building permits issued

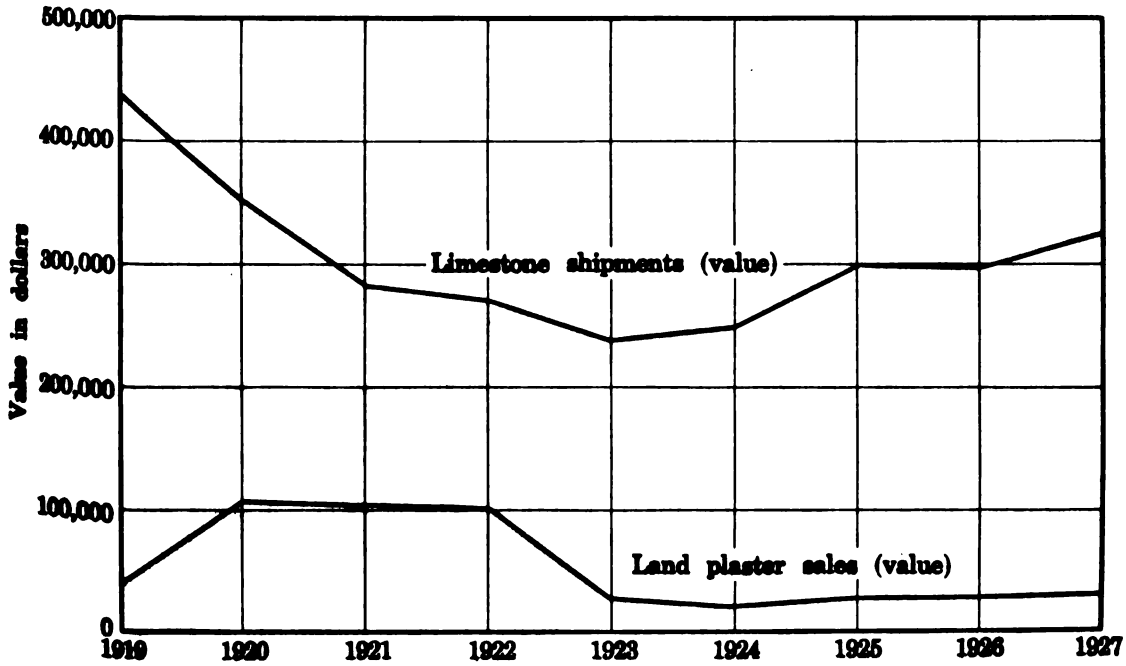

Figure 2.– Comparison of gypsum land plaster sales with limestone shipments

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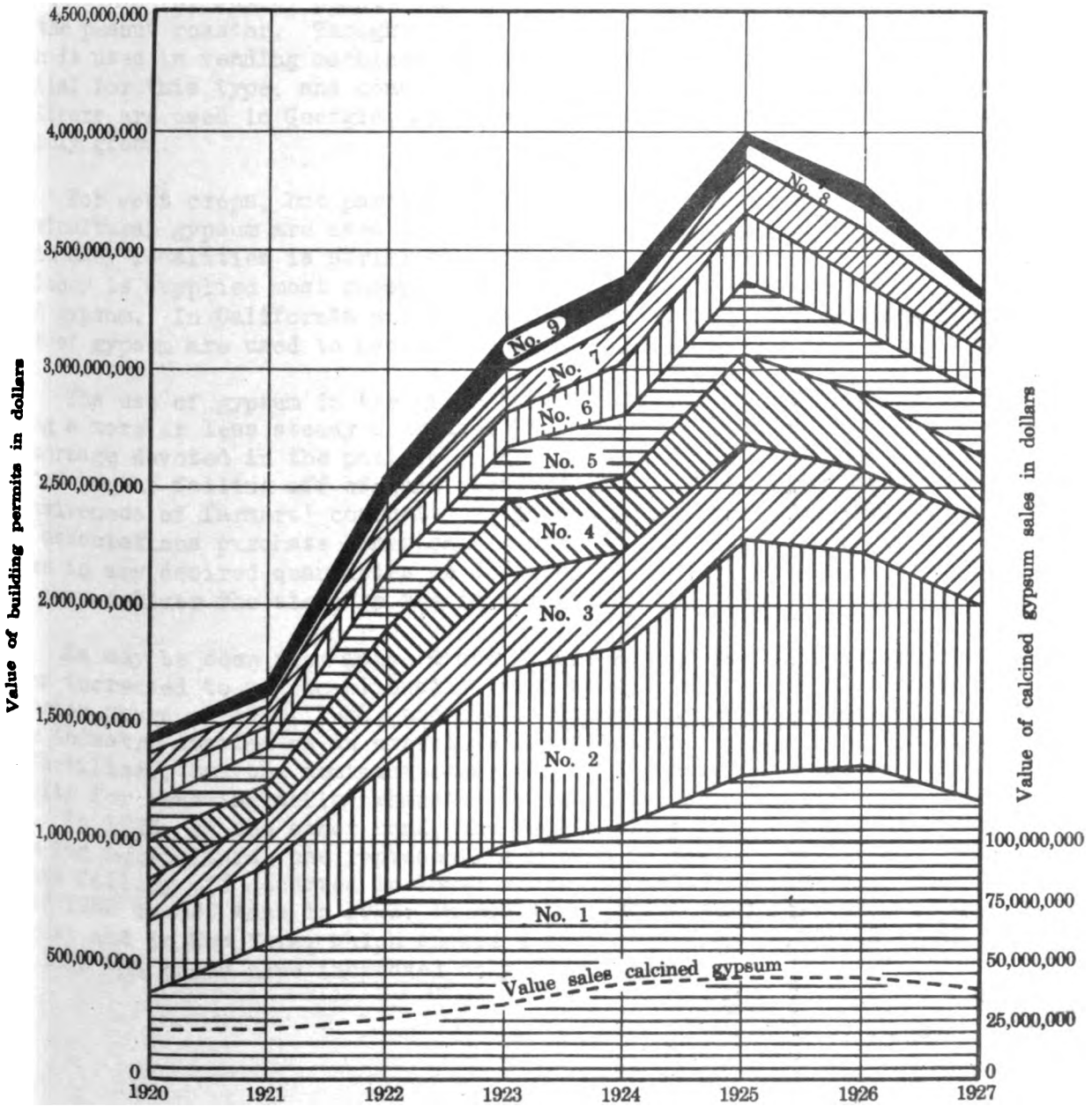

Figure 3. — Value of building permits issued by districts, and sales of calcined gypsum in the United States, 1920-1927

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At the present time the largest consumption of gypsum as a land plaster is in the peanut-growing areas of Virginia and North Carolina, where between 12,000 and 15,000 tons are used annually. This concentration of demand is explained by the fact that gypsum appears to be essential to the growing of the large Virginia (or Jumbo) peanut which is the one commonly sold in the shell from the peanut roaster. Though a good fertilizer for the smaller Spanish nut, (which is used in vending machines and by candy makers) gypsum is not so essential for this type, and consequently relatively small amounts of gypsum fertilizers are used in Georgia, Alabama, and Texas, where the Spanish variety is mainly grown.

For most crops, but particularly for alfalfa, considerable quantities of agricultural gypsum are used in Washington and Oregon. In these States the soil in many localities is strikingly deficient in sulphate sulphur, and this deficiency is supplied most cheaply and effectively by the application of finely ground gypsum. In California and some other western States considerable quantities of gypsum are used to neutralize black alkali.

The use of gypsum in the grain belt in the Central States has been showing a more or less steady decrease. Here the soy bean has usurped considerable acreage devoted in the past to corn. Another factor that may have contributed to the falling off of land plaster sales in the Middle West is the aggressiveness of farmers' community associations in furnishing limestone. These associations purchase limestone in carload lots and sell it to the farmers in any desired quantities on deferred payments. In the majority of cases they deliver the stone to the farmer's back door from the railroad cars.

As may be seen from Table 4 and Figure 2, the sales of gypsum as land plaster increased to an exceptionally large amount during the otherwise depression years of 1920, 1921, and 1922. It was during this period that the gypsum industry carried on an extensive advertising campaign in favor of gypsum as a fertilizer, but the dominant cause for this sudden increase was the necessity for renewing soils exhausted by intensive farming during the war years. In 1923, on the other hand, the sudden slump in the sales of ground gypsum for agricultural use represents a return to normal conditions. The greatest falling off occurred in Iowa, where the sales dropped from 45,062 short tons in 1922 to 329 tons in 1923; in Michigan, where they fell from 13,054 to 616 tons; and in New York, which showed a shrinkage from 13,708 to 1,249 tons. Since 1923 the sales have increased only very slightly.

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Table 4.- Comparison of Sales of Gypsum and Limestone for use as Fertilizer.

Year	Sales of gypsum as land plaster		Sales of limestone for fertilizer	
	Quantity, short tons	Value	Quantity, short tons	Value
1918	64,571	$255,716	391,047	$2,698,848
1919	39,978	185,566	438,632	3,345,039
1920	107,443	557,925	351,851	3,096,705
1921	104,966	490,902	284,722	2,237,510
1922	101,904	387,203	272,726	2,005,082
1923	25,426	150,026	240,551	1,825,519
1924	22,298	125,612	248,336	1,864,514
1925	26,001	153,902	296,976	2,129,169
1926	27,294	151,916	297,010	2,153,233
1927	29,452	129,825	322,893	2,237,871

BUILDING CONSTRUCTION MATERIALS

Gypsum, either as finely crushed rock or gypsite (earthy gypsum), when heated to about 230 to 260°F. boils violently and evolves much of its water of crystallization as steam. The material is then "plaster of Paris," which upon the addition of water, sets rapidly and forms a hard rock-like substance. This plaster of Paris is used, sometimes alone but more often mixed with inert substances, in the manufacture of wall plaster, blocks and tile, wall board and plaster board, lath, wall finishes, etc.

All gypsum wall plasters have other materials added to the calcined gypsum either before sacking or just before wetting for use. These plasters, commonly known as hard wall plasters, (of which there are many brands), may be grouped into four classes, namely: (1) Cement plaster - calcined gypsum, retarder, and with or without hair; (2) wood-fibre plaster - calcined gypsum, retarder, and wood fibre; (3) prepared plaster - calcined gypsum, retarder, sand, and hair or wood fibre; and (4) finishing plaster - calcined gypsum, with or without retarder, and with or without hydrated lime.

Plaster board, a relatively new product, has contributed largely to the rapidly growing use of gypsum in the building construction industry in recent years. It may be divided into three classes, namely: (1) Wall board, to be used without plaster; (2) plaster board, upon which plaster is to be applied; and (3) gypsum lath, a plaster board of smaller dimensions which is used to replace wood or metal lath.

Another group of gypsum products which has forged rapidly into popular favor comprises gypsum blocks and tile. These are used for partitions, both load-bearing and non-load-bearing, floors, roofs, and furring.

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Keene's cement, one of the oldest products manufactured from calcined gypsum, has followed the general upward trend of the other gypsum building materials. It consists of dead-burned gypsum, generally heated to 900 to 1,100° F., to which the property of quicksetting is restored by the use of certain salts.

Tables 5 and 6 show the production of crude gypsum and sales of calcined gypsum in the United States for the years 1890 to 1927, inclusive, and the division of sales into the several products for the same years.

Table 5.-Production of gypsum and sales of calcined gypsum in the United States

Year	Gypsum produced	Sales of calcined gypsum	
	Short tons	Short tons	Value
1890	182,995	79,257	$412,361
1891	208,126	100,006	482,005
1892	256,259	106,141	508,448
1893	253,615	122,937	518,390
1894	239,312	127,158	609,626
1895	265,503	150,801	674,255
1896	224,254	137,505	494,461
1897	288,982	180,935	661,761
1898	291,638	190,083	657,303
1899	486,235	286,227	1,119,521
1900	594,462	396,284	1,500,270
1901	633,791	399,686	1,325,317
1902	816,478	539,387	1,889,190
1903	1,041,704	742,543	3,550,390
1904	940,917	665,340	2,580,601
1905	1,043,202	736,708	2,848,906
1906	1,540,585	899,581	3,220,138
1907	1,751,748	1,125,301	4,402,196
1908	1,721,829	1,125,617	3,650,192
1909	2,252,785	1,514,037	5,354,229
1910	2,379,057	1,583,669	5,853,532
1911	2,323,970	1,598,418	5,872,556
1912	2,500,757	1,731,674	5,940,386
1913	2,599,508	1,773,849	6,077,756
1914	2,476,465	1,656,066	6,249,190
1915	2,447,611	1,613,720	5,946,018
1916	2,757,730	1,805,814	7,168,602
1917	2,696,226	1,677,390	9,992,082
1918	2,057,015	1,328,269	10,234,302
1919	2,420,163	1,596,020	14,209,704
1920	3,129,142	1,904,484	21,967,870
1921	2,890,794	1,796,851	21,434,279
1922	3,779,949	2,491,265	26,917,805
1923	4,753,448	3,101,378	32,310,719
1924	5,042,629	3,568,569	40,050,187
1925	5,678,302	4,096,357	44,754,011
1926	5,635,441	4,015,974	44,211,334
1927	5,346,888	3,912,211	39,785,791

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Table 6.- Gypsum produced and sold in the United States[1] (Short tons)

Use	1922 Quantity	1922 Value	1923 Quantity	1923 Value	1924 Quantity	1924 Value
Calcined:						
Stucco	396,990	$ 2,813,561	455,161	$ 3,106,333	600,955	$ 3,849,971
Neat plaster	1,333,261	12,126,811	1,536,077	13,061,700	1,712,589	13,895,969
Sanded plaster	80,455	1,165,771	178,016	1,191,473	166,910	1,179,826
Mixed plaster	2/ 218,650	2/ 1,914,572	2/ 268,271	2/ 2,373,276	2/ 193,635	2/ 1,534,836
Plaster of Paris, molding, casting plaster, etc.	3/ 126,288	3/ 1,198,819	3/ 155,295	3/ 1,585,585	3/ 193,971	3/ 1,903,493
Keenes cement	21,991	324,316	23,273	323,127	30,620	428,684
To plate-glass works	- - -	- - -	21,435	163,358	18,847	138,444
Plaster board	42,088	945,171	68,431	727,562	86,018	1,924,394
Wall board	120,591	4,500,725	197,218	7,131,668	391,457	12,859,411
Partition tile	68,338	915,449	134,437	1,537,783	121,604	1,492,550
Special tile or blocks	44,834	368,068	22,456	293,512	23,457	345,847
Other purposes 4/	37,779	644,542	41,308	815,342	28,506	496,762
Total calcined	2,491,265	26,917,805	3,101,378	32,310,719	3,568,569	40,050,187
Crude:	770,725	2,443,346	847,242	2,577,436	982,108	2,674,320
Total value		$29,361,151		$34,888,155		$42,724,507

Use	1925 Quantity	1925 Value	1926 Quantity	1926 Value	1927 Quantity	1927 Value
Calcined:						
Stucco	634,714	$ 3,930,714	543,729	$ 3,365,116	421,987	$ 2,493,910
Neat plaster	2,187,721	16,737,733	2,150,243	16,066,220	2,069,945	14,324,857
Sanded plaster	184,850	1,331,784	133,255	869,208	207,210	1,414,749
Mixed plaster						
Plaster of Paris, molding, casting plaster, etc.	3/ 187,058	3/ 1,888,941	3/ 206,226	3/ 2,014,926	3/ 173,080	3/ 1,542,916
Keenes cement	36,607	503,397	42,436	603,761	41,431	574,698
To plate-glass works	19,536	148,398	14,589	114,767	18,372	132,203
Plaster board	110,703	2,766,079	166,866	3,194,194	249,219	4,669,562
Wall board	422,863	13,812,230	444,056	14,408,796	415,082	11,165,965
Partition tile	245,853	2,542,228	231,571	2,476,807	231,044	2,102,985
Special tile or blocks	8,654	97,408	28,730	315,097	21,701	280,436
Other purposes 4/	57,798	995,099	54,273	782,422	63,140	983,510
Total calcined	4,096,357	44,754,011	4,015,974	44,211,334	3,912,211	39,785,791
Crude:	1,014,135	2,823,229	961,363	2,509,885	965,371	2,388,663
Total value		$47,577,240		$46,721,219		$42,174,454

1/ Mineral Resources of the United States, U. S. Bureau of Mines. 2/ Includes small quantity of wood-fibre plaster. 3/ Includes dental plaster and plaster sold to plate-glass works. 4/ Includes roof tile and material used for [illegible] wall boards; and insulating material, fireproofing [illegible]

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It may be seen from Table 6 that a rapidly growing proportion of the crude gypsum mined was used for calcining into plaster of Paris, etc. It was not, however, until the beginning of the 20th century that the greatest increase in use of calcined products took place. About that time gypsum wall board, plaster board, block, and tile were first put on the market in quantity and met with practically immediate success. At the same time, sales of gypsum wall plaster in all grades assumed noteworthy proportions; it is estimated that between 80 and 90 per cent of the calcined gypsum produced was used for this purpose. This may be due, especially in certain years, to the demand for plaster "staff" used in the construction of temporary buildings. The great increases in 1902 and 1903 were the results of the demand for this plaster at the Louisiana Purchase Exposition at St. Louis, and the decrease in 1904 represented the return to a normal trend; but, as may be seen from the table, the trend during the next six years turned sharply upward as a result of the remarkable growth in the production of plaster, and during 1909 reached the unusually high figure of 1,514,037 tons.

This normal trend held steadily during the 10-year period up to the beginning of the World War, the net increase being about 104 per cent in the sales of calcined gypsum.

In 1915 two expositions were held in California, the Panama-Pacific Exposition at San Francisco and the Panama-California Exposition at San Diego. The large quantities of plaster "staff" required for these temporary buildings were the principal causes for the growth in the sales of plaster of Paris during 1912 and 1913. Practically all the gypsum for the Panama-California Exposition and at least 80 per cent of that for the Panama-Pacific Exposition buildings was quarried near Nephi, Utah.

Consolidations within the industry constituted its outstanding feature during the four years prior to the World War. With consolidations came higher and more stable prices. The greatest increases in the price of calcined gypsum, however, came in the war years, 1917 to 1919. In 1915, calcined gypsum sold for an average of $3.68 per short ton. In 1917, however, the price advanced to $5.96 per ton and then increased rapidly until in 1921 it reached the highest in the history of the industry, $11.93 per ton. Consolidations within the industry still form the outstanding feature, and the practice of economy with closer competition has had the effect of reducing the price of calcined gypsum, until in 1927 it had fallen to $10.17 per ton.

The price of land plaster followed closely the trend in the price of calcined gypsum, with the exception that the height was not reached until 1925. In 1915, prior to our entry into the World War, land plaster was sold for $1.77 per short ton. This price rose rapidly during the World War and reached its maximum in 1925, when it was sold for $5.92 per ton. Since then there has been a downward trend, the price being $4.41 per ton in 1927.

The price of crude gypsum in 1915 was $1.30 per ton, the lowest since 1904. The rapid rise in price during the war years, reaching $3.57 per ton in 1920, was followed by a downward trend to $2.41 per ton in 1927.

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While there has been a downward trend in the prices of gypsum and gypsum products during the past few years, there is nevertheless a substantial gain - in some cases over 200 per cent - over those prices prevailing prior to the World War.

SHIPPING OF GYPSUM BUILDING MATERIALS

Gypsum building materials, especially plasters, because of their rapid deterioration in the presence of moisture are usually shipped in sound box cars, although in emergencies shipments have been made on tarpaulin-covered flat cars. For wall plasters the minimum carload varies from 15 to 30 tons. The smaller minimum ordinarily carries a somewhat higher rate and is used in shipping to small towns where there might be some deterioration of the plaster in the warehouse before a large carload could be disposed of.

Wall plaster is always sold in bags, either of jute or of paper. Jute bags contain 100 pounds (net) each. They are charged for separately at a price which, though it varies from time to time more or less in accordance with the market price of jute, generally averages $3 per ton of plaster.[3] These bags, provided they are returned in good condition, carriage prepaid, within six months, are redeemed by the shipper at the same price originally charged for them. The time limit of six months is merely nominal; plaster manufacturers often will redeem bags returned even two or three years later.

The jute-bag department is an important feature of a large mill and adds greatly to the warehouse space required and to the work of the accounting department. Because of this trouble and expense the gypsum plaster industry has made determined efforts to encourage shipments in paper instead of jute bags, and within the past two years these efforts have met with remarkable success. To reduce breakage the contents of the paper container is limited to 80 pounds, so that 25 instead of 20 bags are needed for each ton of plaster. For gypsum plaster shipped in paper the extra charge for bags is from $1 to $1.50 per ton of plaster, and the bags are not redeemable. When shipments are made in paper, the floor and sides of the car must be lined with felt paper or old burlap to prevent perforations, and 25 or more empty bags are sent with each car to replace any that may be broken in transit.

With the improved styles of self-closing multiwall paper bags and the machines used for filling them, it seems likely that practically all plasters will be shipped in paper containers before long.

Plaster board, wall board, lath, and blocks and tiles are usually shipped in box cars and require only nominal shoring to keep the material in place. Lath is put up in 6 and 9 sheet bundles which weigh about 60 pounds. They are protected along the edges by heavy kraft paper and are loaded into boxcars in the same manner as blocks and tile.

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3 - Wilder, F. A., Marketing of Gypsum. Eng. and Min. Jour. Press; vol. 117, No. 10, Mar. 8, 1924, pp. 403-406.

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DISTRIBUTION OF GYPSUM PRODUCTS PLANTS

In 1927, as shown in the following table, there were 60 plants in operation in the United States. This figure represents only those plants that calcine domestic gypsum and is the lowest with the exception of that for 1926 (59 plants) for the past eight years. It may also be seen that the plants which use domestic gypsum are well distributed throughout the United States, except in New England, in the Southeast, and in the Pacific Northwest. In the New England States, California, and the Pacific Northwestern States, there are additional plants, but they are not shown in the table because they use imported gypsum; those in New England obtaining their rock from Nova Scotia and those in the latter two localities importing rock from San Marcos Island, Lower California, are not shown.

The southeastern section of the United States is the only one in which there are no plants treating either foreign or domestic gypsum. This is explained in part by the absence of known commercial deposits of gypsum and in part by relatively small local demand. Increased demand, however, is indicated by reports that a gypsum-products plant is being erected at Tampa, Fla., to utilize calcium sulphate waste from phosphoric-acid manufacture.

The manufacture of gypsum products is becoming more and more centralized at points of consumption. There is considerable new construction underway, but as new plants are built, obsolete or badly situated plants will be closed down or dismantled. Table 7 shows the number of plants in the United States using domestic gypsum.

Table 7.- Location of plants in the United States using Domestic Gypsum

States	1920	1921	1922	1923	1924	1925	1926	1927
Iowa	6	6	6	7	6	7	7	7
Kansas	3	3	3	3	3	3	3	3
Michigan	6	5	6	6	8	5	5	6
Nevada	4	4	5	4	6	6	5	5
New York	8	9	8	8	13	9	11	11
Ohio	3	3	3	3	4	3	3	3
Oklahoma	4	3	5	4	5	4	3	4
Texas	5	4	5	4	7	6	5	4
Utah	1/-	3	3	3	4	1/-	3	1/-
Wyoming	4	5	5	4	3	1/-	1/-	1/-
Other States	18	17	15	16	13	18	14	17
Total	61	62	64	62	72	61	59	60

1/ Included in "Other States."

CORRELATION OF GYPSUM SALES AND GENERAL BUILDING CONSTRUCTION FIGURES

The sales of calcined gypsum in the United States - at least for the period, 1920 - 1927, follow closely the value of new buildings as shown by permits issued.

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Table 8.- Summary of building permits in the United States for the years 1920-1927 [1]
(In thousands of dollars)

District	Group of Cities 2/	1920	1921	1922	1923	1924	1925	1926	1927
1	New York and northern New Jersey	$ 369,711	$ 562,755	$ 773,747	$ 977,231	$1,071,288	$1,278,820	$1,317,632	$1,168,161
2	Illinois, Indiana, Iowa, Wisconsin, Michigan, Missouri, Kansas, Nebraska, and Oklahoma	295,225	341,117	556,604	726,467	769,645	906,186	894,393	826,340
3	California, Washington, and Oregon	168,927	201,989	302,006	408,351	394,940	417,065	359,802	329,098
4	Eastern Pennsylvania, southern New Jersey, Maryland, Delaware, District of Columbia, and Virginia	160,753	143,081	287,528	308,741	334,366	386,637	316,990	259,844
5	Western Pennsylvania, West Virginia, Ohio, and Kentucky	167,770	146,805	214,628	243,190	265,343	309,712	273,862	253,640
6	New England	101,449	84,907	152,680	153,719	209,983	251,184	198,844	190,541
7	North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Tennessee, Arkansas, and Louisiana	78,759	79,630	119,858	145,596	176,363	234,617	228,085	156,265
8	Arizona and Texas	48,269	46,830	55,205	64,974	76,869	98,083	94,769	85,278
9	Minnesota, North Dakota, South Dakota, Colorado, Utah, Montana, Idaho, and Wyoming	53,313	61,638	91,582	112,189	92,891	105,171	74,444	69,355
	Total	1,444,176	1,668,752	2,553,838	3,140,458	3,391,688	3,987,475	3,758,821	3,338,522

1/ From Bulletin of Portland Cement Association showing values tabulated in detail by cities, based on Bradstreet's and The American Contractor Building statistics.

2/ Years 1920 to 1923, inclusive, represent 180 cities; 1924 to 1927, 210 cities.

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The close correlation between these two sets of yearly figures for the country as a whole is shown clearly in Figure 3 and Table 8. Moreover, an analysis of the detailed tables herein presented shows that a similar correlation exists with respect to the leading subdivisions of the country, indicating that each of the smaller areas, with the exception of the Southeastern States, is relatively self-contained as regards supplies of finished gypsum products for its local markets.

For the purpose of studying this phase of the gypsum industry, the United States has been arbitrarily divided into nine districts (disregarding New Mexico and Nevada, where the volume of new buildings is too small to have much effect upon the total for the United States, though both States produce and manufacture gypsum products.) These districts correspond to the territorial classification employed in the Bulletin of the Portland Cement Association, which in turn was based on Bradstreet's and the American Contractor's building statistics.

District 1: In 1927 district 1, comprising New York State and northern New Jersey, issued building permits to the value of $1,168,161,000, or 35 per cent of the total of $3,338,522,000 for the United States in that year. The industry in this district is situated in the vicinity of Akron, at Newburgh, at New York City, and at Newark, N. J.; the latter plant, however, closed down in 1928. In 1927 the 15 producers operating in these four fields produced and sold 1,573,910 short tons of calcined gypsum valued at $17,934,419, or 40 per cent of the total value of the sales ($44,811,681) for that year. The daily capacity of the plants in operation is estimated at 9,660 tons, or about 32 per cent of all the plants in the United States. Since 1927, however, new plants have been put in operation, using imported Canadian crude gypsum or waste calcium sulphate from the manufacture of chemicals.

Table 9 shows the location and number of kettles and kilns and their capacities for 1927.

Table 9.- Calcining kettles and kilns reported by gypsum producers in the United States, 1927, by districts 1/

District	Number of producers and importers	Kettles		Rotary kilns		Total daily capacity, short tons
		Number	Daily capacity, short tons	Number	Daily capacity, short tons	
1	15	37	5,840	12	3,820	9,660
2	20	71	8,809	2	200	9,029
3	4	10	750	-	-	750
4	4	11	2,415	-	-	2,415
2/6	8	23	2,617	3	300	2,917
7						
8	6	42	3,020	-	-	3,020
9	11	24	1,500	-	-	1,500
Total	71	226	26,201	17	4,320	30,541

1/ Original producers' schedules.
2/ Includes Nevada and New Mexico.

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District 2:- The second largest district (No. 2) as regards value of new building permits, comprises the Middle-Western States. In this group gypsum products are actually manufactured from domestic material in only four States; Iowa, Michigan, Kansas, and Oklahoma; but the other States, Illinois, Indiana, Wisconsin, Missouri, and Nebraska, all fall in the same market area. This district issued building permits to the value of $826,340,000 in 1927, or 25 per cent of the total issued in the United States. For the four States in this district that manufactured gypsum products, the sales of calcined gypsum amounted to 1,304,354 short tons valued at $13,052,296, or 30 per cent of the total quantity and 29 per cent of the total value for the country during 1927. Of the 19 plants in operation during this year in this district, the average daily capacity was 9,029 tons, or nearly 30 per cent of the grand total.

District 3:- For the next largest district (No. 3) comprising California, Washington and Oregon, the value of the building permits issued in 1927 was $329,098,000. This amount represents 10 per cent of the total issued in the United States. California was the only one of these States in which domestic gypsum was calcined, but other plants in California and Washington produced gypsum products from imported Mexican material. The daily capacity of plants in these States constitutes about 2½ per cent of the total for the country. One new plant has started operations in this district since 1927.

District 4:- The Middle Atlantic section, district 4, (comprising eastern Pennsylvania, southern New Jersey, Maryland, Delaware, District of Columbia, and Virginia) is one of the few areas that fails to provide the bulk of its supplies of gypsum products from local plants. It ranks fourth in the value of building permits issued, but its gypsum calcining industry is of only minor importance in relation to the size of the industry as a whole. This region, besides being furnished with plaster products from the two plants in southwestern Virginia using domestic gypsum and the plant at Chester, Pa., using imported Canadian rock, relies to a great extent upon water-borne shipments from the plants in the vicinity of New York City. Gypsum plants in western New York and north-central Ohio also ship considerable quantities of gypsum products into this area, and, in fact, plants as far west as Iowa and Kansas find a considerable sale for their products in this market. The value of the building permits issued in this district in 1927 was a little less than 8 per cent of the total for the United States, the figures amounting to $259,844,000 out of a total of $3,338,522,000.

The daily capacity of the plants in this district is estimated at 2,415 short tons or 8 per cent of the plant capacity of the United States as a whole.

District 5:- The fifth district, on the other hand, manufactures sufficient gypsum products for its own needs. In 1927 this territory, which comprises western Pennsylvania, West Virginia, Ohio, and Kentucky, issued building permits to the value of $253,640,000, or 8 per cent of the total, whereas its three plants using domestic gypsum (all located in north-central Ohio) produced and sold in 1927 calcined gypsum amounting to 456,817 short tons and valued at $5,011,118, or 11 per cent of the quantity and value for the country as a whole. The average daily capacity represents 4 per cent of the total, or 1,250 tons. A large part of Ohio's gypsum products is shipped outside the State for consumption, especially to ports along the Great Lakes in order to take advantage of the cheap water rates contributing to this result.

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District 6:- In the sixth district, which comprises the New England States, there are no plants which use domestic gypsum. This territory is fairly well supplied with calcining and fabricating plants, but these use imported Canadian rock or calcium sulphate waste from the manufacture of chemicals.

During 1927 building permits were issued in New England to the value of $190,541,000, or 4 per cent of the total for the United States. During this year the plants in this district imported and sold about 299,901 short tons of calcined gypsum valued at approximately $2,181,553. Since then several new plants have started operations, using Canadian gypsum or calcium sulphate waste.

District 7:- In the seventh district, which comprises the States of North and South Carolina, Georgia, Florida, Alabama, Mississippi, Tennessee, Arkansas, and Louisiana, there were in 1927 no gypsum calcining plants in operation, although one of the large fertilizer companies is reported to have started to erect a gypsum products plant at Tampa, Fla., to utilize waste from the manufacture of phosphoric acid. This entire southeastern part of the United States issued building permits to the value of $156,265,000 in 1927, or a little less than 5 per cent of the total, but it relies entirely for its needs upon gypsum products brought in from other sections of the country.

On the basis of its building operations in 1927, this district should require about 55,000 tons of gypsum products annually. This quantity is now derived approximately as follows: From the New York district (by water to South Atlantic and Gulf ports), 15 per cent o4 8,000 short tons; from southwestern Virginia (by rail), 36 per cent or 20,000 tons; from north-central Ohio (by rail), 7 per cent or 4,000 tons; from Michigan and Iowa, 4 per cent or 2,500 tons; from Kansas and Oklahoma, 4 per cent or 2,500 tons; and from Texas, 33 per cent or 18,000 tons.

District 8:- In 1927 the eighth district which includes the States of Arizona and Texas, issued building permits to the value of $85,278,000, or 3 per cent of the total, but its six plants, having a daily capacity of 3,020 tons, or 10 per cent of the total, sold only 397,530 tons of calcined typsum valued at $4,024,713, or less than 1 per cent of the total quantity and about 9 per cent of the total value for the United States. The deficit was made up by shipments from New Mexico, Oklahoma, and Kansas, although a small tonnage of gypsum products was also shipped out of Texas, as noted previously.

District 9:- The ninth district, comprising Minnesota, North and South Dakota, Colorado, Utah, Montana, and Idaho, issued building permits in 1927 valued at $69,355,000, or 2 per cent of the United States' total. Eleven plants were in operation during the year, having a daily capacity of 1,500 tons or 5 per cent of the total, and selling 100,327 tons of calcined gypsum valued at $756,417 or 2 per cent of the quantity and less than 2 per cent of the total sales in the United States.

The States of Nevada and New Mexico, which are not included in the statistics covering the value of building permits issued in 1927, had six calcining plants using domestic crude gypsum.

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Table 10 shows the sales of crude and calcined gypsum by producers and importers and by districts.

Table 10.- Crude and calcined gypsum sold by producers and importers in 1927, by districts. 1/

District	Number of producers or importers	Sold crude		Sold calcined		Total value
		Quantity, short tons	Value	Quantity, short tons	Value	
1	15	370,172	$1,089,579	1,573,910	$17,934,419	$19,023,998
2	20	419,091	925,849	1,304,354	13,052,296	13,978,145
3	4	68,972	150,362	68,394	376,019	526,381
4	4	71,243	302,966	113,773	1,475,146	1,778,112
5	3	11,210	30,761	456,817	5,011,118	5,041,879
2/ 6	8	66,878	193,031	299,901	2,181,553	2,374,584
3/ 7	-	-	-	-	-	-
8	6	28,662	57,598	397,530	4,024,713	4,082,311
9	11	35,873	94,384	100,327	756,417	850,801
Total	71	1,072,101	$2,844,530	4,315,006	$44,811,681	$47,656,211

1/ Original producers' schedules.
2/ Includes Nevada and New Mexico.
3/ No plants in this district.

MARKET ANALYSIS

It is common knowledge that much more attention has been given in the past to the efficiency of production than to the efficiency of market distribution. Production has been studied, labor-saving devices have been invented, and mechanical power has largely displaced handwork. As a result, production costs at the average factory have been satisfactorily reduced. Only comparatively recently, however, has much critical or serious attention been given to the study of market distribution.

At present the location of gypsum products plants with reference to consuming markets necessitates, in some instances, exceptionally long freight hauls. Especially true is this of those districts which have an excess of products above their own requirements and which are therefore compelled to seek markets more or less at a distance.

This condition is the natural result of erecting at the most likely deposits of gypsum, plants that can produce far more than the nearby territory can possible absorb. Numerous plants, though erected at very good deposits of gypsum, have had to close down indefinitely after operating a year or so at a loss. The records of California and New York especially are filled with such instances. The deposits in these States, being exceptionally large and numerous, have attracted a generous supply of capital for their exploitation. Gypsum plants erected in the past in Nevada, New Mexico, Colorado, and Oklahoma likewise seldom operated more than a year or so before being compelled to close down.

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To-day, in these four States there are only 11 plants in operation -- an exceptionally small number as compared with the number that have actually been built and operated.

Many other firms throughout the United States have failed because they neglected to analyze the selling possibilities of their product prior to the erection of their plants, because they made a product unsuitable to their markets, or because through using wrong selling policies they were unable to cultivate the potential demand of their markets. A few companies have tried to introduce products with which the local market was not at all familiar, and have not had enough money set aside to carry on the requisite educational advertising campaign. Architects and building contractors are seldom familiar enough with the possibilities and good points of gypsum building materials to advise the prospective builder or home owner what gypsum materials to ask for. In consequence, considerable effort and money have been expended in the past in educating the building supply dealer concerning gypsum building materials, but as gypsum products are only one of a number of building materials handled, the dealers are more inclined to sell the product which has the least selling resistence. On the other hand, through the efforts of the gypsum products salesmen, dealers in building supplies sometimes stock too heavily with products not known in their market area, only to find out too late that they can not sell them.

In order to have any advantage in railroad freight rates the dealers must purchase their material in carload lots, but they sell to the builder generally in smaller quantities. As a rule their capital is limited and their warehouse space small, but even if they had sufficient capital it would not be a good business policy to keep it tied up for long periods in idle inventories. Moreover, gypsum products, especially plasters, deteriorate with time, and this reason alone forces the smaller supply dealer to purchase in less than carload lots and consequently to pay a higher freight rate. Since many deliveries have to be made in less than carload lots and since occasional delays in transportation are inevitable, it is obviously desirable to have sufficient stocks of goods carried to points near the ultimate consumer so that deliveries can be made cheaply and quickly.

Because of the bulkiness and comparative cheapness of most gypsum building materials it is not economically possible for the smaller manufacturers to maintain their own warehousing facilities always at the most strategic points in their market areas. The larger manufacturers, on the other hand, are able to do this, and consequently they are frequently better able to compete for the business in a given area. One of the larger companies manufacturing gypsum products has its warehouses distributed throughout the United States. In the past several of the larger producers also had their own retail branches, but instead of selling direct to the consumer in competition with dealers that handled their own goods, the manufacturers have finally decided to work only through the regular building-supply houses in each territory. It is now reported that there are no retail branches in existence in the gypsum industry in this country.

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Freight Rates

Table 11 gives the freight rates in effect as of March 21, 1929, on the principal gypsum building materials from the important producing points to the main centers of consumption. The map (fig. 4) shows these points of production and the market that each plant serves.

Practically every plant located in the United States is adequately served by one or more railroads, and many of them are able also to make shipments direct by water. While it is known that the transportation facilities have not kept pace with the expanding area of the markets and the increased quantities of goods to be transported, the motor truck has replaced, to a considerable degree, the railroad in all short-haul shipments; to a certain extent this has allowed the railroads to handle more economically the longer hauls.

The shipments of crude gypsum from Canada to the fabricating plants along the North Atlantic seaboard are all water-borne; one company at least, owns its own vessels.

Declaring that imports have driven the New York State producers out of the seaboard markets, the domestic gypsum producers in a brief presented in January, 1929, before the Ways and Means Committee, stated: 4/

> "- - the principal importer from the Canadian fields brings in this partly manufactured material to the producers' principal markets at a cost of $1.15 per short ton. The average cost to the New York State producers of laying down the crushed rock at the same markets is a minimum of $5.30 per short ton. As the manufacturing costs are substantially the same at all points in this country, this differential of $4.15 is maintained on all gypsum products, the difference between $5.30 and $1.15 as above.
>
> Gypsum shipped from the New York State fields in calcined forms costs, delivered to their principal markets, $10.60 per short ton, including sacks. Most of the gypsum shipped is wall plaster and costs the New York producers $11.25 per short ton delivered to Newark, N. J., and New York City and $12.05 per short ton at Washington and $12.25 per short ton at Boston and New England points. This includes sacks. Present selling prices including sacks, at Newark, New York City, and Philadelphia are $10.50 per short ton, at Washington, $11.80 per short ton, and at Boston and New England points $11.50 per short ton. The importers maintain their mills for calcining the Canadian material at Portsmouth, N. H., Boston, New Haven, New York City, Newark, N. J., Philadelphia and Chester, Pa., with plants proposed and projected at other points on the South Atlantic seaboard and on the Gulf of

4 - Tariff Readjustment, 1929, Hearings before the Ways and Means Committee, House of Representatives, 70th Congress, 2d Session, vol. 2, Schedule 2, 1929, p. 1037.

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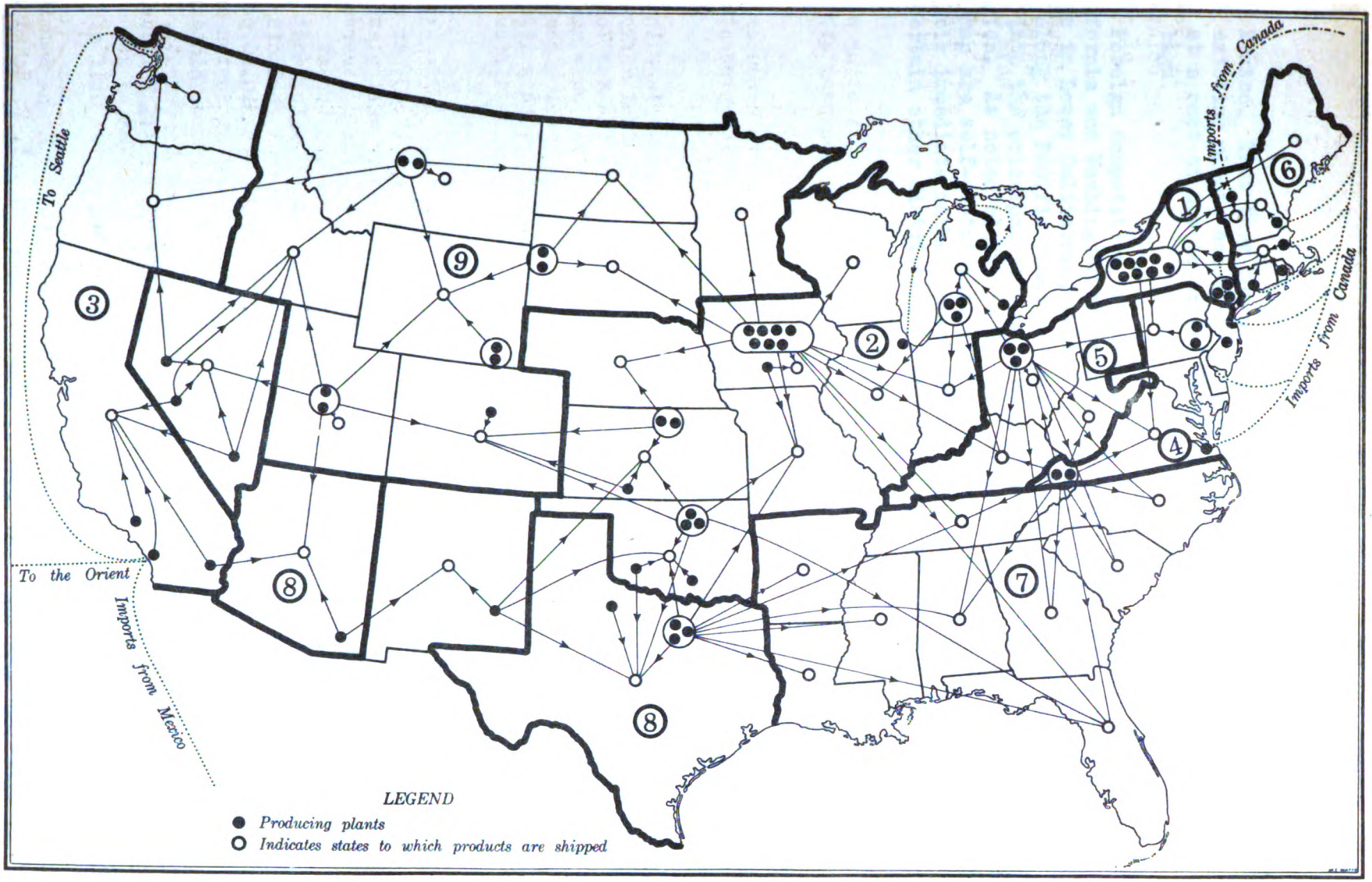

Figure 4.– Market areas for gypsum products

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Mexico. Thus they can deliver wall plaster with their existing plants and with those proposed at seaboard points at a cost of not to exceed $6,85 per short ton, including bags.

Foreign competition is likewise a factor on the Pacific coast; plants in California and Washington receive their supplies of crude gypsum from deposits in Lower California, Mexico, as the freight rates from Mexico to points along the Pacific coast are much less than from the Rocky Mountain States into the principal consuming markets in California, Oregon, and Washington. As noted elsewhere in this paper, several of the districts shown on the map are self-sustaining, other of the districts produce more products than their immediate market can absorb and ship into neighboring States, while certain other districts rely entirely upon shipments from outside.

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Table 11.- Schedule of freight rates on gypsum products 1/
(Cents per 100 pounds)

District	Distribution	Gypsum plaster	Gypsum plaster board	Gypsum wall board	Gypsum blocks	Gypsum building tile
1	Akron, N. Y., to:					
	Boston, Mass.	22½	25	2/ 28½	22½	3/ 28½
	New York, N. Y.	17½	19½	2/ 26½	17½	3/ 26½
	Philadelphia, Pa.	17½	19½	2/ 26½	17½	3/ 26½
	Baltimore, Md.	17½	19½	2/ 26½	17½	3/ 26½
	Albany, N. Y.	14	16	2/ 21½	16	3/ 21½
	Buffalo, N. Y.	7	8	2/ 9	7	3/ 9
2	Fort Dodge, Iowa, to:					
	Minneapolis, Minn.	4/ 14	4/ 14	2/ 21	5/ 15½	3/ 15½
	Milwaukee, Wis.	6/ 14½	4/ 17½	2/ 27½	5/ 20½	3/ 20½
	Chicago, Ill.	6/ 14½	4/ 17½	2/ 27½	5/ 20½	3/ 20½
	St. Louis, Mo.	4/ 18	7/ 18	2/ 29½	5/ 20½	3/ 20½
	Kansas City, Mo.	4/ 12	4/ 12	2/ 26	5/ 17	3/ 17
	Des Moines, Iowa	13½	13½	20½	15	15
	Pierre, S. Dak.	33½	33½	2/ 50	5/ 34½	3/ 34½
	Bismarck, N. Dak.	7/ 18	7/ 18	21	15½	15½
		4/ 14	4/ 14	2/ 45½	5/ 30½	3/ 30½
	Medicine Lodge, Kans., to:					
	Los Angeles, Calif.	44½	44½	2/ 135	44½	3/ 110
	Chicago, Ill.	4/ 26½	4/ 26½	2/ 65	4/ 26½	3/ 38
	Denver, Colo.	8/ 56½	8/ 56½	2/ 56½	5/ 44½	3/ 44½
	St. Louis, Mo.	24½	24½	2/ 54	24½	3/ 32
	Memphis, Tenn.	24½	24½	2/ 64	24½	3/ 37
	New Orleans, La.	31½	31½	2/ 71	31½	3/ 42
	Galveston, Tex.	8/ 64	8/ 64	2/ 64	5/ 37	3/ 37
	Omaha, Nebr.	18½	18½	2/ 47	18½	3/ 27
	Grand Rapids, Mich., to:					
	Detroit, Mich.	14	14	2/ 19	10½	10½
	Chicago, Ill.	16	16	2/ 20½	11¼	11¼
	Cleveland, Ohio	17½	17½	2/ 22½	13½	13½
	St. Louis, Mo.	20	20	2/ 27½	17¼	17¼
	Pittsburgh, Pa.	20½	20½	2/ 26½	16½	16½

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District	Distribution	Gypsum plaster	Gypsum plaster board	Gypsum wall board	Gypsum blocks	Gypsum building tile
	Acme, Okla., to:					
	Los Angeles, Calif.	44½	44½	2/ 135	44½	3/ 110
	Chicago, Ill.	24	24	2/ 71	5/ 41	24
	Denver, Colo.	20½	20½	2/ 80	5/ 56⅓	20⅓
	St. Louis, Mo.	4/ 17½	4/ 17½	2/ 60	5/ 35	4/ 17½
	Memphis, Tenn.	20⅓	20⅓	2/ 57	5/ 33	20⅓
	New Orleans, La.	4/ 25	4/ 25	2/ 65	5/ 38	4/ 25
	Galveston, Tex.	28	28	2/ 67½	28	3/ 45½
	Omaha, Nebr.	4/ 17	4/ 17	2/ 67	5/ 33	4/ 17½
3	Long Beach, Calif., to:					
	Los Angeles, Calif.	4	5	5	5	5
	Phoenix, Ariz.	23½	23½	23½	23½	23½
	San Francisco, Calif.	20	20	20	20	20
	San Diego, Calif.	13	13	13	13	13
	Midland, Calif., to:					
	Los Angeles, Calif.	11	11	11	11	11
	Phoenix, Ariz.	19	19	19	19	19
	San Francisco, Calif.	22½	22½	22½	22½	22½
	San Diego, Calif.	16	16	16	16	16
4	Port Clinton, Ohio, to:					
	Detroit, Mich.	11⅓	11⅓	2/ 15	10½	10⅓
	Chicago, Ill.	17½	17½	2/ 22½	11¼	11¼
	Cleveland, Ohio	11	11	2/ 14⅓	13⅓	13⅓
	Pittsburgh, Pa.	15½	15½	2/ 21	16½	16½
	Cincinnati, Ohio	14½	14½	2/ 21	14¼	14¼
	Buffalo, N. Y.	15½	15½	2/ 22	15¾	15¾
	Charleston, West Va.	16	16	2/ 23	18	18
6	Plasterco, Va., to:					
	Charleston, S. C.	19½	2/ 45	2/ 45	19½	19½
	Savannah, Ga.	19½	2/ 45	2/ 45	19½	19½
	Jacksonville, Fla.	19½	2/ 52	2/ 52	19½	19½
	Wilmington, N. C.	28½	2/ 44	2/ 44	5/ 44	3/ 44
	Atlanta, Ga.	19½	2/ 41	2/ 41	5/ 41	3/ 41
	Richmond, Va.	15½	15½	4/ 36½	15½	15½
	Norfolk, Va.	15½	15½	2/ 46	15½	15½
	Baltimore, Md.	21½	21½	2/ 43	21½	21½
	Charleston, W. Va.	19½	19½	2/ 33½	19½	19½
	Pittsburgh, Pa.	22½	22½	2/ 40	22½	22½

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District	Distribution	Gypsum plaster	Gypsum plaster board	Gypsum wall board	Gypsum blocks	Gypsum building tile
8	Douglas, Ariz., to:					
	Phoenix, Ariz.	18½	18½	18½	25	18½
	El Paso, Tex.	11½	11½	11½	11½	11½
	Denver, Colo.	42	42	42	5/ 84½	3/ 84½
	Deming, N. M.	17½	17½	17½	17½	17½
	El Centro, Calif.	25	25	25	25	25
	Sweetwater, Tex., to:					
	Los Angeles, Calif.	44½	44½	2/ 135	5/ 110	3/ 110
	Chicago, Ill.	30½	30½	2/ 82	5/ 48	3/ 48
	Denver, Colo.	4/ 22½	4/ 22½	2/ 99	22½	67
	St. Louis, Mo.	24½	24½	2/ 71	5/ 41	3/ 41
	Memphis, Tenn.	24½	24½	2/ 64	5/ 37	3/ 37
	New Orleans, La.	4/ 25	4/ 25	2/ 65	5/ 38	3/ 38
	Galveston, Tex.	8/ 58½	8/ 58½	2/ 58½	5/ 41½	3/ 41½
	Omaha, Nebr.	24½	24½	2/ 70	5/ 41	3/ 41
9	Loveland, Colo., to:					
	Denver, Colo.	9	9	9	10	9
	Salt Lake City, Utah	10/ 36	10/ 36	11/ 45	48	48
	Omaha, Nebr.	20½	20½	20½	26½	41
	Kansas City, Kans.	33	33	40	26½	41
	Portland, Colo., to:					
	Denver, Colo.	12/ 9	9	9	5/ 15½	3/ 15½
	Salt Lake City, Utah	36	2/ 79	2/ 79	5/ 44½	3/ 44½
	Omaha, Nebr.	20½	20½	20½	5/ 41	41
	Kansas City, Kans.	12/ 18	18	18	41	41
	Heath, Mont., to:					
	Seattle, Wash.	13/ 25	13/ 25	13/ 14/ 25½	13/ 15/ 25½	10/ 16/ 26½
	Portland, Oreg.	13/ 25	13/ 25	13/ 14/ 25	13/ 15/ 25½	13/ 16/ 25½
	Butte, Mont.	17/ 17	17/ 17	17/ 17	17/ 17	17/ 17
	Boise, Idaho	10/ 37	10/ 37	10/ 14/ 37	10/ 15/ 37	10/ 16/ 37
	Piedmont, S. Dak., to:					
	Omaha, Nebr.	10/ 14½	10/ 14½	10/ 14½	5/ 35	3/ 35
	Cheyenne, Wyo.	20½	20½	20½	5/ 37	3/ 37
	Denver, Colo.	20½	20½	20½	5/ 37	3/ 37
	Minneapolis, Minn.	22	22	22	5/ 38½	3/ 38½
	St. Paul, Minn.	22	22	22	5/ 38½	3/ 38½

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District	Distribution	Gypsum plaster	Gypsum plaster board	Gypsum wall board	Gypsum blocks	Gypsum building tile
Nephi, Utah, to:						
	Denver, Colo.	8/ 106	2/ 106	2/ 106	5/ 51	3/ 51
	Los Angeles, Calif.	25	2/ 49⅓	49½	49½	49½
	Portland, Oreg.	8/ 83	2/ 83	2/ 83	5/ 57	3/ 57
	Seattle, Wash.	8/ 96	2/ 96	2/ 96	5/ 67	3/ 67
Kane, Wyo., to:						
	Boise, Idaho	103	103	103	5/ 108½	3/ 108½
	Denver, Colo.	8/ 61	2/ 61	2/ 61	5/ 38½	3/ 38½
	Portland, Oreg.	10/ 57	10/ 57	81	103	17/ 119½
	Cheyenne, Wyo.	8/ 61	2/ 61	2/ 61	29½	3/ 38½
Laramie, Wyo., to:						
	Boise, Idaho	10/ 37	10/ 37 10/	14/ 37	99	99
	Denver, Colo.	18/ 9	18/ 9 14/	18/ 9	18/ 19/ 13½	3/ 22½
	Portland, Oreg.	13/ 33½	13/ 33½	14/ 33½	5/ 103	17/ 119½
	Cheyenne, Wyo.	18/ 9	18/ 9 14/	18/ 9	18/ 19/ 13½	3/ 11½
Acme, N. Mex., to: 20/						
	Topeka, Kans.	18½	18½	18½	18½	18½
	Kansas City, Kans.	18½	18½	18½	18½	18½
	Wichita, Kans.	18½	18½	18½	18½	18½
	Oklahoma City, Okla.	18½	18½	18½	18½	18½
	Fort Worth, Tex.	29½	29½	29½	29½	29½
	Dallas, Tex.	29½	29½	29½	29½	29½
	Austin, Tex.	29½	29½	29½	29½	29½
	Denver, Colo.	26½	26½	26½	26½	26½
	El Paso, Tex.	17½	17½	17½	17½	17½
Arden, Nev., to: 16/						
	Sacramento, Calif.	25	25	25	25	25
	Los Angeles, Calif.	13½	13½	13½	13½	13½
	Reno, Nev.	54	54	54	44½	44½
	Salt Lake City, Utah	31	31	31	31	31
Ludwig, Nev., to: 16/						
	Sacramento, Calif.	15½	15½	15½	15½	15½
	Los Angeles, Calif.	25	25	25	25	25
	Reno, Nev.	11	11	11	11	11
	Salt Lake City, Utah	20	20	20	20	20

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Notes:-

1/ As compiled by Interstate Commerce Commission as of March 21, 1929.
2/ Class rate per rating on:
"Boards-
Wall:
Plaster boards (fibre-board, pulp-board, straw-board, felt or fibre and plaster combined)."
3/ Class rate per rating on "Tile, building, hollow."
4/ Maximum weight 60,000 pounds.
5/ Class rate per rating on artificial stone building blocks, not in imitation of chiseled, dressed, hammered, or sand-rubbed natural stone.
6/ Maximum weight 80,000 pounds.
7/ Maximum weight 40,000 pounds.
8/ Class rate on "Plaster, wall minimum weight 40,000 pounds and board-plaster, minimum weight 36,000 pounds."
9/ Class rate per Virginia classification on "Plaster Boards."
10/ Minimum weight 60,000 pounds.
11/ Minimum weight 50,000 pounds.
12/ Commodity rate on wall plaster.
13/ Minimum weight 80,000 pounds.
14/ Commodity rate on plaster board.
15/ Commodity rate on plaster blocks.
16/ Commodity rate on plaster tile.
17/ Minimum weight 40,000 pounds.
18/ Minimum weight 30,000 pounds.
19/ Commodity rate on cement plaster blocks.
20/ Not included in the compilation showing value of building permits issued.

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